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Recommended Citation

Matook, Sabine and Kautz, Karlheinz, "Mindfulness and Agile Software Development" (2008). *ACIS 2008 Proceedings*. 58.
<http://aisel.aisnet.org/acis2008/58>

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Mindfulness and Agile Software Development

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Abstract

The field of information systems development (ISD) is still not well understood and suffers from a lack of sustainable theories which are firmly based on research of ISD practice. This is also true for agile software development (ASD). In this paper, we develop a framework based on the theory of mindfulness and map the main characteristics of mindfulness to the most prominent features of ASD. By applying the framework to a case study of ASD practice we demonstrate the relationship between the theory of mindfulness and ASD, and show the usefulness of our framework as a contribution to theorizing about ASD and to a better understanding of ASD in practice.

Keywords

Information systems development, agile software development, mindfulness.

INTRODUCTION

The field of information systems development (ISD) is still not well understood and suffers from a lack of sustainable theories, which are firmly based on research of ISD practice (Kautz, 2004). This is also true for agile software development (ASD). The concept ASD serves as an umbrella for a number of pragmatic approaches, which have emerged out of a critique of traditional, document driven development approaches (Highsmith, 2002). ASD has gained immense popularity among practitioners and academics since the late 1990ties as an approach, which flexibly deals with change as it is encountered in software development practice, and no downturn of this interest is in sight (Abrahamsson et al., 2003). However, Conboy and Fitzgerald (2004) state that in the area of ASD a lack of theoretical grounding exists and they are supported by a more recent literature study by Dybå and Dingsøyr (2008).

Also Highsmith (2000), one of the most significant proponents of ASD, is aware of the pragmatic grounding of ASD and recognises the need for theoretical grounding as, “techniques without a theoretical base are reduced to a series of steps executed by rote.” He asserts that complex adaptive systems (CAS) theory builds the basis for agile development methods (Highsmith, 2002). However, this claim is a post-rationalization, as the theory, for example in Highsmith’s own writing (Highsmith, 2000; Highsmith, 2002), is used in a very lax manner to justify what is done in practice (Vidgen and Wang, 2006).

Against this backdrop, in one of the few attempts to provide a theoretical grounding for ASD, Vidgen and Wang (2006) used CAS theory to built a framework and showed its usefulness in a case study where they found a strong correspondence between CAS theory and ASD practice. In a follow-up study they (Wang and Vidgen, 2007) developed another framework, which takes as a starting point the four pairs of values, which according to the original advocates of agile development guide ASD and which can be found in all agile development methods.

These values have been put down in the so-called agile manifesto and they are: (1) *individuals and interactions* over processes and tools, (2) *working software* over comprehensive documentation, (3) *customer collaboration* over contract negotiation, and (4) *responding to change* over following a plan (see www.agilemanifesto.org). Based on a comparative case study, which investigated two projects Wang and Vidgen (2007) concluded (1) that an agile process is able to balance order and chaos and to poise at the edge of chaos, in the region of emergent complexity and (2) that agile processes are not the opposite of structure and planning, rather, structure and planning are integral elements of agile processes.

Recently, Butler and Gray (2006) put forward an alternative theoretical grounding. They argued that the recent interest in ASD methods also reflects a desire for techniques that promote mindfulness. Mindfulness includes the attention to detail, the willingness to consider alternatives, and responsiveness to changes (Langer, 1997). It endorses openness to novelty and an orientation in the present. As such, it shows some similarities to the four privileged agile values. Butler and Gray (2006) continued their argument and stated that mindfulness theory might provide a way to explain how ASD can contribute to the production of reliable information systems, and why developers' departures from structured methodologies may benefit their projects. They, however, did not provide any framework for studying the relationship between mindfulness and ASD, neither from a theoretical nor a practical perspective. In this paper we develop such a framework and map the main characteristics of mindfulness on the four pairs of agile values. By applying this framework to a case study of ASD practice, we demonstrate the relationship between a theory of mindfulness and ASD and show the usefulness of our framework as a contribution to theorizing about ASD and to a better understanding of ASD in practice.

The remainder of the paper is structured as follows: In the next section we present the theoretical background on mindfulness and agile system development. We then introduce the case setting and the research approach, which we applied. Following, we present instances of mindful behaviour from our empirical data and briefly discuss our findings. Finally, we provide some conclusions.

THEORETICAL BACKGROUND

Butler and Gray (2006) present a conceptual essay, in which they discuss the relationship between reliability, mindfulness and information systems and its implications for IS use and development. They base their argument mainly on the work of the social psychologist Langer (1992, 1997) and the organisational theorists Weick and Sutcliffe (2001)¹. The following presentation of the concept of mindfulness and its relationship to agile software development, which provides the grounding for the theoretical framework of our study largely follows these texts. According to Weick and Sutcliffe (2001) mindfulness stresses situated human cognition as the solution to individual and organizational problems and Langer (1997) puts forward that a mindful response "to a particular situation is not an attempt to make the best choice from among available options but to create options." Thus, Butler and Gray (2006) suggest that mindfulness-based approaches to problem solving, such as ISD, explain the ability of individuals and organizations to achieve performance in changing environments. The ability depends on how both, individuals and organizations cognitively think: how they gather information, how they perceive the world around them, and whether they are able to change their perspective to reflect the situation. To reflect the distinction between individuals' and organizations' abilities they distinguish between individual and collective mindfulness. In the subsequent subsections we will introduce these concepts in more detail.

Individual Mindfulness

According to Langer (1997) at the individual level, mindfulness lays emphasis on the ability to constantly create and use new categories in the perception and interpretation of the world. In contrast, Chanowitz and Langer (1980) describe mindlessness is a state of reduced attention, which results from premature commitment to beliefs that may not accurately reflect the phenomena at hand.

To conceptualize mindfulness, we follow Langer (1997), who distinguishes five constituent components, which are presented in Table 1: (1) openness to novelty, (2) alertness to distinction, (3) sensitivity to different contexts, (4) awareness of multiple perspectives, and (5) orientation in the present.

Openness to novelty is the ability to reason about and to cope with novel kinds of stimuli. Alertness to distinction is the ability to compare new categories with existing ones and decide if things are the same or different. This is specifically important when defining the nature of a problem as it can help to decrease the risk of misdiagnosing a problem. Sensitivity to context is an awareness of the characteristics of any specific situation, which an individual faces. This is a prerequisite to being able to notice when situational traits change. Awareness of multiple perspectives enables people to perceive and analyse things from different and opposing points of view. Finally, individuals, who are oriented to the present, devote more of their attention to their immediate situation. In this context Sternberg (2000) argues that people, who pay attention to their actual surroundings, behave more mindfully than those, who are careless about what is happening.

People, who are mindfully engaged in a procedure, perceive changes in an environment. Therefore, there is a probability that they are more creative and that they are more likely to adopt new ways of working. Thus it is also more likely that they find innovative solutions to problems and that they by altering their actions will take advantage of new situations.

¹ The idea of mindfulness is however much older; it is an ancient Buddhist concept linked to Buddhist meditation and has been related to 'the art of conscious living' (see Kabat-Zinn, 1994).

Table 1. Aspects of individual Mindfulness

Aspect	Characteristic
1) Openness to novelty	Ability to reason about and to cope with novel kinds of stimuli
2) Alertness to distinction	Ability to compare, contrast and judge about how things are the same or different
3) Sensitivity to different contexts	Awareness of situational characteristics to notice when and whether a setting changes
4) Awareness of multiple perspectives	Appreciation of things from different and opposing points of view
5) Orientation in the present	Individual's attention to their immediate situation and their actual surroundings

Collective Mindfulness

The relation between organizational mindfulness and individual mindfulness is like the relation between collective learning and individual learning. Collective mindfulness presents a theoretical elaboration of the cognitive concepts related to individual mindfulness on the organizational level such as a business unit, a work group, or a whole organization. Collective mindfulness is also known as organizational mindfulness (Butler and Gray, 2006).

In collective mindfulness, existing expectations are continuously scrutinized and refined according to new experiences in order to be able to invent new expectations for dealing with unprecedented situations to improve foresight and current functioning (Weick and Sutcliffe, 2001). Examples include hospitals providing services under tight resource constraints, but also mundane organizations such as restaurants. According to Weick and Sutcliffe (2001) there are five key aspects, which characterize collective mindfulness. These are (1) preoccupation with failure, (2) reluctance to simplify, (3) attention to operations, (4) commitment to resilience, and (5) migration of decisions to expertise (see Table 2).

Preoccupation with failure focuses on the utilization of errors and failures as a way of improvement. Emphasizing errors and failures is helpful to prevent overconfidence in and inattention to a given situation. The organizational desire to continuously view problems from different points of view is referred to as reluctance to simplify. This is helpful in order to recognize minor anomalies and errors and to react appropriately to prevent larger failure in the future. Attention to operations focuses on individuals' (capability to develop an) integrated overall picture of the operations in an organization or project. Commitment on resilience as opposed to focus on planning is the ability to cope with problems and dangers as they occur. Finally, the migration of decisions to expertise allows for circumventing organizational hierarchies and for migrating the problems to those experts, who are most capable of solving them.

Table 2. Aspects of collective Mindfulness

Aspect	Characteristic
1) Preoccupation with failure	Utilization of errors and failures as a way of improvement
2) Reluctance to simplify	Organizational aspiration to perceive problems from different points of view
3) Attention to operations	Individuals' capability to have an integrated overall picture of the operations in an organization or project
4) Commitment to resilience	Ability to cope with problems and dangers as they occur
5) Migration of decisions to expertise	Migrating the problems to the experts, who are most capable of solving them, regardless of hierarchical levels

In summary, Butler and Gray (2006) propose that collective mindfulness is associated with cultures and structures that promote open discussion and it increases organizations' ability to perform in dynamic, unstable environments. They put forward that "...collective mindfulness is not simply the result of having individually mindful personnel. In general, mindfulness involves the ability to detect important aspects of the context and take timely, appropriate action" (Butler and Gray, 2006, p.216) and continue that "... collective mindfulness requires organizations to couple the ability to quickly detect issues, problems, or opportunities with the power to make organizationally significant decisions. This may be accomplished by moving decision-making authority or creating an organizational environment that enables the smooth interaction of perception and action". (Butler and Gray, 2006, p.216).

These are characteristics, which are also associated with ASD. Lyytinen and Rose (2006), for example provide their understanding of agility in the context of ISD as, "agility can be defined as ISD organisations' ability to sense and respond swiftly to technical changes and new business opportunities" and accordingly an agile ISD organization is "one that develops and maintains information systems has the capability to sense and respond to unexpected environmental changes and to hone these skills to quickly deliver information systems." Erickson et al. (2005) are even more specific when it comes to what agility means in the context of ISD, namely "At its core, agility means to strip away as much of the heaviness, commonly associated with traditional software-development methodologies, [...] to promote quick response to changing environments, changes in user requirements, accelerated project deadlines, and the like." Thus, the concept of mindfulness might offer a theoretical foundation for understanding ASD. In the following we therefore first map the characteristics of ASD and mindfulness and then demonstrate its usefulness with a brief case study.

Agile Systems Development and Mindfulness

ASD is guided by the four pairs of values, which were presented in the introduction of this article. In the agile manifesto they are elaborated further through 12 guiding principles (see www.agilemanifesto.org). In the following we will map these values and principles to the constituent components and key aspects of individual and collective mindfulness.

Individuals and interactions over processes and tools

The agile principles underline that business people, customers, users and developers must work together daily throughout a development endeavour to achieve the project's goals. Further more, they underline that projects should be build around motivated individuals who should be trusted and should be provided with the environment and the support they need to get their jobs done. In this context self-organizing teams are promoted as the organizational unit from which the best architectures, requirements, and designs emerge. The principles also state that the most efficient and effective method of conveying information to and within a development team is face-to-face conversation. Thus, at regular intervals, the team should reflect on how to become more effective, then tune and adjust its behaviour accordingly.

From a perspective of mindfulness theory this emphasis on individuals and interactions is mirrored in the concepts of openness to novelty, alertness to distinction, sensitivity to different contexts and awareness of multiple perspectives, which underline individuals' and interactions' capabilities to create and handle novelty, to assess similarities, dissimilarities and situational change and which salute contrasts and opposition. Taking collective mindfulness into account the allocation of problems to those, who are most qualified to solve them, is obviously supported by such an approach as is the skill to handle predicaments as they happen and the organizational ambition to understand problems from different points of view. This shows that at least reluctance to simplify, the commitment to resilience, and the migration of decision to expertise are echoed in ASD.

Working software over comprehensive documentation

Working software is considered the primary measure of progress in ASD and its highest priority is to satisfy the customer through early and continuous delivery of valuable software. To achieve this objective the frequent delivery and evaluation of working software, from a couple of weeks to a couple of months, with a preference to the shorter timescale, is aspired to while continuous attention is paid to technical excellence and good design of the working software. Simplicity, the art of maximizing the amount of work not done, is essential in that context. Indeed, ASD does not neglect sustainable development and aims at enabling sponsors, developers, and users to maintain a constant development pace indefinitely.

From a perspective of mindfulness theory the constant release of working software implies an ability to deal with novel kinds of stimuli and with change, to appreciate different viewpoints, to compare and appraise consistency and modifications, to take different view points into account and to be able to focus on the presence. Thus, all elements of individual mindfulness are reflected in ASD. But prioritizing working software also means to be willing to utilize errors and failures as a way of improving the product; exposing the working software to

other developers and to users entails a readiness to perceive problems from different points of view and to cope with them when they occur. The short development cycles of the software parts suggest letting experts work with this task and underlines the need for some individuals, who have an overall picture of the development process and the future product. This confirms the close relationship between collective mindfulness and the value of appreciating working software over documentation.

Customer collaboration over contract negotiation

As stated above, the ASD values and principles postulate that business people, customers, users and developers must co-operate on a daily base during a development project. These values and principals also stipulate that the team, including the customer and user representatives, regularly evaluates its conduct, performance and actions.

This of course means that ASD embraces an openness to novelty, an alertness to distinction, a sensitivity to context, an awareness of multiple perspectives, and an orientation in the present as well as a reluctance to simplify, a commitment to resilience and a migration of decision making and problem solving to the respective experts. As such, all concepts related to individual mindfulness and the majority of the concepts related to collective mindfulness can be connected to the ASD value of appreciating customer collaboration over contract negotiation.

Responding to change over following a plan

The ASD values and principles welcome changing requirements, even late in the development process and harness change for the customer's competitive advantage while, as stated above, keeping the amount of work performed to implement a change and produce a new release as low as possible. The frequent delivery and evaluation of working software, sustainable development as well as its good design and technical excellence certainly facilitate responding to change as does the co-operation of the different stakeholder groups and a working environment, which cherishes trust, expertise, and direct communication. In such a context, all aspects of individual mindfulness are taken into consideration as well as all key aspects of collective mindfulness are dealt with.

In the following we will demonstrate how the theory of mindfulness can be applied in a case study to provide a better understanding of ASD in practice. Before doing so, we will briefly introduce our case setting and research method.

CASE SETTING AND RESEARCH METHOD

The research presented in this paper is interpretive and is based on an empirical case study. The case company is a German water supplier, which we call WaterWorks. It was founded in the 1850ies and has been partially privatised in 1999. Since 1999 the city council holds 50.1% and 49.9% are in private hand. The firm provides town water supply as well as sewage and wastewater recycling for 3.5 million people. The company has 4,500 employees and realised a total income in 2006 of 1.26 million Euros.

The project under investigation was concerned with the development of an operations management system (OMS) for WaterWorks by a small software company, AgDev, which had specialised on ASD. The system was developed with a web-based graphical user interface and a backend to interface the technical infrastructure as defined by an underlying ERP system. The project was organized in 4 subprojects to provide IT support ranging from customer management to the maintenance of the sewer system.

At the time of the data collection, AgDev consisted of 25 employees, 20 of them being developers, and based its development approach on the agile method XP (Beck and Andres, 2004). The method includes planning techniques for releases and iterations called planning games, user stories and story cards to specify user requirements, onsite customers to support customer-developer communication, daily meetings (stand-up meetings) of the whole project team to support team communication, pair programming, re-factoring, collective ownership, continuous integration and software testing, and tuning workshops to improve the development processes regularly.

The project was organised in 2 phases. In a first 12 months exploration phase, prototypes catching requirements and possible solutions were developed. This led to the development of a comprehensive requirements document by the customer organisation and their decision to contract AgDev also for the development of the OMS. In this main development phase, a team of 12 development staff with multiple roles such as project manager, analyst, customer contact, and developer worked onsite in a building owned by WaterWorks. The project team also consisted of a varying number of users with at least one representing one of the subprojects. These users were, however, not the entire time onsite. A sophisticated management structure was established with one subproject manager also acting as contact person from AgDev and one subproject manager also acting as onsite-customer from WaterWorks for each individual subproject. The development team consisted of project managers, who

had quite some experience with ASD, and of highly educated and motivated, young staff with little to no experience with ASD, but none of them had ever participated in such a large project.

When the data collection for this study was performed phase 1 had been successfully completed and phase 2 had been in progress for 4 months. The project ended 10 months later on time with all parts of the IS being operational.

The empirical data for the case study was collected in semi-structured, open-ended interviews, which were conducted by a team of two researchers in a three days period. The research team performed 12 interviews with 11 individuals – the AgDev project manager was interviewed twice, once at the beginning and once at the end of the investigation. The interviews included about half of the development team and a representative sample of key players and future users in the customer organisation. Table 3 presents the roles and affiliation of the interviewees.

The interviews were tape-recorded and subsequently transcribed to be processed in a qualitative data analysis. We used the qualitative software tool NVIVO 7 for this purpose. The coding and analysis of the data for this particular study have been guided by the four pairs of values and the twelve principles underlying ASD and the ten concepts derived from mindfulness theory. This study is part of a larger research project, which aims at understanding and theorizing about ASD in practice, which so far has been documented in Kautz and Zumpe (2008) and Zumpe and Kautz (2008).

Table 3. The Interview Partners

Name	Role	Affiliation
Mr. A	Project Manager/analyst/developer	AgDev (2 interviews)
Mr. B	Project Manager	WaterWorks
Mr. C	Developer	AgDev
Mr. D	Developer	AgDev
Mr. E	Subproject manager/onsite user	WaterWorks
Mr. F	Subproject contact/analyst/developer	AgDev
Mr. G	Subproject contact/developer	AgDev
Mr. H	Chief IT co-ordinator	WaterWorks
Ms. K	Subproject contact/developer	AgDev
Mr. L	Subproject manager/onsite user	WaterWorks
Mr. M	Developer	AgDev

MINDFUL BEHAVIOUR IN THE OMS PROJECT

The OMS project was described by both the customer and the supplier as a success. In a presentation to the board the project champion at WaterWorks said: *“I am with the company now for 25 years but I never experienced a project that could generate output so fast.”* One of the WaterWorks subproject managers explicated: *“Our users have been very satisfied”* and the project manager confirmed that the agile concept of working software as the measurement of project progress was much appreciated as *“it was amazing to have something to test so quickly.”* The project provided already after the initial exploration phase various benefits to the company, for example time savings and cost reductions. The emerging information system afforded, in the words of a WaterWorks subproject manager, *“to identify synergies among the various departments”* and in particular in the duct department it enabled improved planning that resulted in the possibility to *“dispose cleaning vehicles and reduce related staff.”*

Throughout the project we observed openness to novelty both with regard to ASD and the problem at hand by both the developers and the customers. This was for example expressed through a strong desire, motivation and pleasure to learn as described by one AgDev subproject manager: *“I enjoyed the learning. It was something new every day.”* and one developer stated: *“Sure, I had to catch-up and even now, I still need to learn a lot, but I meet with interesting people and they help me through.”* In addition, the project managers as well the subproject managers paid attention to the operation and had an overall picture of the project.

In the following we present and discuss more instances of mindful behaviour in the OMS project. This presentation is again structured according to the four value pairs of ASD.

Individuals and Interaction over Processes and Tools

XP provides a number of processes and tools such as short releases and iterations, planning games, user stories, story cards, onsite users, pair programming, collective ownership, and stand-up meetings to carry out ASD. In the OMS project pair programming was a prominent process to support the interaction of the individuals of the development teams by working in shifting pairs of developers in front of a screen while implementing the requirements written down as user stories on story cards as executable code. Two sub-processes or mechanisms here were important: 1) to regularly shift a partner and 2) to regularly shift possession of the keyboard within a team.

In the project the developers found it difficult to find the appropriate synchronization points at which to change a partner in the teams of 4 developers. No common practice existed. However they did not follow an overly bureaucratic rule such as shifting partner every morning regardless of the status of a story card. To avoid both too much red tape and too much chaos, some developers preferred to stay with a partner until a card was closed. *"... changing a partner was always a problem, it still is as changing in the middle of a card seems foolish to me and I don't really like doing it ..."* said one developer. This of course could lead to limited interaction, spread of knowledge and dead ends. Thus, although some uncertainty regarding the mandate existed, a subproject leader might intervene if a pair had worked together for too long, i.e. three days. In doing so, a balance was created between shifting too often and not shifting at all.

The developers started out with a practice, which did not really support the objectives of interaction, namely that one developer exclusively held the keyboard and programmed, while the other watched and sometimes commented. To avoid such situations a process was introduced where using a stopwatch after 20 minutes the keyboard had to switch. This was however abandoned as too bureaucratic and not fruitful in a creative work environment. The teams found their own rhythm. *"We don't do that anymore. It didn't function. Now it also functions without any explicit rule."* was how one developer commented the emerged practice.

This had also been the case with stand-up meetings. They were performed by all teams together everyday before lunch with the purpose to keep everyone up to date with the current status of the project and to exchange useful information. These sessions originally were quite detailed and long, but they had been refined and were then acknowledged as very helpful. One AgDev subproject manager described: *"In the beginning we did this all together, but we found out that it can become too much, as some are doing something that is not of interest for other teams. But it is good to know what others do. It does not have to be in detail. And that is what the teams do now, all teams, but we keep it short."* Other intensive interaction took place in the beginning of each iteration, where all story cards were jointly discussed.

Despite the fact that these mechanisms could not totally provide the intended collective ownership as the project leader regretted and explained with the size of the teams, they present mindful behaviour in the form of alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, orientation to the present as well a willingness to learn from errors, an aspiration to perceive problems from different perspectives, an ability to cope with problems and the migration of decision to expertise. All these contributed to the progress of the project; they kept the project teams informed and decreased the need for documentation, a topic, which will be discussed in the next subsection.

Working Software over Comprehensive Documentation

In the OMS project working software was the measure of progress. Software releases were provided every 3-6 months with each release being organised in iterations of 3-6 weeks duration. Beyond this, working software was also, as mentioned above, presented to the customer in shorter cycles as for example one AgDev subproject manager described: *"We really try to show something every week ... there we make a presentation and demonstrate the software. It is a great way to get fast feedback"*.

Each iteration produced operational software, but also minor advancements were demonstrated to the customers. The WaterWorks project manager stated: *"... I have never experienced a project that could generate output so fast."* and continued *"The major benefit is that we do not work so abstract, but rather focus on the real thing."* One of his subproject managers added to this *"... this way we have seen that we are on the right way, as we can use 95% of what has been developed this way, and just the last 5% we have to do something with again ..."*. This was confirmed by one developer by saying *"Yes, that functioned well, we made all 3 weeks a short presentation of the running software."* and another one extended this: *"...we got very quick feedback when we showed what we had done."* Thus, the short feedback cycles presented the appropriate mindful behaviour for the development of the working software. But mindful behaviour was also shown in the way the team handled documents.

A number of different documents existed as a prerequisite to develop the working software, but they were all comparably short and concise. From a customer perspective they were related as follows: *"We have ... the requirement list. These lists govern what should be the outcome of an iteration. For me this is the basis for my*

acceptance test: has been achieved what is on the list? And on the level below there are the story cards, these, so to speak, represent the detailed specifications and plans for the developers' process." The developers shared this perception and confirmed that the documents, both in length and in number, were adequate. One of them said: *"Absolutely sufficient"* and was acceded by a colleague: *"I flipped through the realization document in the beginning and never touched it afterwards ... the requirements change anyway every 2nd week."*

These examples again demonstrate how alertness to distinction, sensitivity to different contexts, awareness of multiple perspectives, orientation to the present, the preoccupation with failure, the reluctance to simplify, commitment to resilience and the migration of decisions were performed and experienced in the OMS project.

Customer Collaboration over Contract Negotiation

Customer collaboration in the OMS project came in different ways. It took the form of onsite customers and users, as well as telephone contact and email correspondence, especially to clarify requirements as specified on story cards. The planning games, the presentations of working software, and the acceptance tests were as well crucial elements, which structured the collaboration.

The planning games were partly based on the overall realization concept, a document, which had been produced by the customer as a basis for the contract. Another foundation of the planning game was the requirement list. These were largely produced by AgDev, both their project leader and some of the subproject leaders, who also worked as contact persons for their counterparts at WaterWorks and as developers. They developed these documents with input from the onsite customers. The story cards were solemnly produced by the developers in team work sessions, where they also estimated them. The developers and the customers then together prioritised these cards.

This could be considered a limited form of customer collaboration, however, as one subproject leader expressed it, there could be a number of reasons for this: *"Here we have users, who have to take their working gloves off before they go to the keyboard ... in contrast to projects I've been involved in before, where the customers were wearing ties, here the subproject leaders are partly folks, who have done something quite different before, they have a different education and that becomes apparent with regard to their abstraction capabilities and their abilities to write down some texts."* Thus, this form of customer collaboration presented a suitable mindful behaviour to cope with the complexities of a comparatively large ASD project, which was performed by a number of inexperienced staff, while leaving room for less structured collaboration as well.

Nevertheless, when implementing the story cards, it became obvious that some additional collaboration was needed. One subproject manager estimated that user contact was necessary for nearly every story card. He put forward that maybe 60% of a card's contents was clear. When no user was onsite available the communication process in the absence of customers and with a lack of information was as follows: *"Certain users want to be contacted by phone to be reached straight away, while others prefer to get their requests via email, but answered timely."*

The overall collaborative spirit of the project showed that the customer collaboration was not replaced by formal contracts and negotiations. The project champion, who after having been involved in the original contract negotiations, supports this view: *"... we decided not to be tough on change requests and back-up formalities, but rather to work constructively with them to make progress. And my good feelings have been confirmed."* The AgDev project leader confirmed this and described the context of requirement changes: *"The customer is quite relaxed. In such situations they look where they can cut expenses planned for other requirements or we discuss if we can make the implementation simpler to meet the budget planned."*

The balance between stability and flexibility was brought about by different kinds of mindful customer collaboration covering all aspects of individual and all aspects of collective mindfulness, may be with the exception of attention to operation. This also extends to the handling of change requests, which we discuss below.

Responding to Change over Following a Plan

As described above, in the OMS project change especially change of requirements was an accepted fact of life. Many change requests were detected through the scheduled acceptance test sessions for an iteration with a customer representative onsite and were then dealt within the next iteration. The customer representatives also performed regularly 'road shows' in the user departments to collect feedback, ideas, and proposals for improvements.

But change requests were also brought forward by the users on a shorter time scale. There were weekly and bi-weekly feedback loops built into an iteration. The AgDev project manager explained: *"And then after a week the customer rep is back and wants to see what happened during the week and he gets the first feedback and this then continues ..."* They had the following consequence: *"... often we show the customer rep something once*

a week and then he's going "I thought this would be different" ... thus there are always small changes ... " as one developer put it.

These frequent feedback loops also had the effect that minor misunderstandings were caught and solved as changes to avoid escalation, as the same developer explained: *"Until now it has not happened that everything was totally wrong; there are of course some refinements or a bug is found or something similar. There is always something."* The feedback was taken seriously and immediately responded to with action: *"Through the feedback we got, we could react directly ..."*

The different feedback mechanisms illustrate mindfulness in the way the changes were handled, but plans and planning - not impeding more spontaneous actions - were playing an important role as well. Even the weekly sessions were to some extent planned, as were of course the acceptance tests. As one WaterWorks subproject leader relating to the size and complexity of the project said *"Planning is essential in such kind of projects."*

Therefore, the project also had an overall long term plan covering a 14 months period anticipating 3-6 releases depending on the subprojects. A more fine-grained plan was developed for the individual iterations, which made up a release detailed to single weeks. The planning game and the story cards then offered the devices to perform planning on the most detailed level for very short periods of time. The frequent planning sessions embedded in a 'larger' and coarser plan together with the different means to handle change are a clear instance of mindful behaviour, which helped moving the project forwards.

CONCLUSION

We have applied mindfulness theory and a framework consisting of ten key elements of individual and collective mindfulness to contribute to an enhanced understanding of ASD and especially ASD in practice. Our study provides a number of illustrative examples, which show how mindful behaviour as part of an ASD approach may contribute to successful ISD.

However, more research applying the theoretical lens of mindfulness and providing more empirical evidence is needed to further the understanding of the phenomenon. Iivari and Maansaari (1998) distinguish between explicit and implicit software development methods use and mindfulness allows us to determine when implicit use refers to the traditional or the agile approach. Furthermore, Butler and Gray (2006) stress the relationship between reliability and information systems and also put mindfulness theory forward as a possible explanation of why developers move from more traditional, 'disciplined' and document driven development approaches to ASD. These are both exciting and significant areas for future research.

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